12-1-1992

The Multiple Admission Factor (MAF) in Small Area Variation Analysis

Kevin Cain
University of Washington, cain@u.washington.edu

Paula Diehr
University of Washington, pdiehr@u.washington.edu

The Multiple Admission Factor (MAF) in Small Area Variation Analysis

By

K.C. Cain, P. Diehr, Z. Ye

Technical Report # 116

December 1992

UNIVERSITY OF WASHINGTON
DEPARTMENT OF BIOSTATISTICS, SC-32
SCHOOL OF PUBLIC HEALTH AND COMMUNITY MEDICINE
SEATTLE, WASHINGTON 98195

December 1992

The Multiple Admission Factor (MAF) in Small Area Variation Analysis

K.C. Cain, P. Diehr, Z. Ye

ABSTRACT

Small area variation analysis are often based on area-level data such as the total number of hospital admissions within an area, rather than person-level data. Such analysis often make the assumption that the number of admissions within a small area follow a Poisson distribution. This may not be a reasonable assumption when multiple admissions per person are possible. In this case, the multiple admission factor (MAF) can be used to adjust for the extra variance introduced by multiple admissions. In this article, data from Washington State are used to estimate the multiple admission rate and the MAF for each modified DRG (M-DRG). Examples are presented which illustrate how these MAF estimates can be used in small area analyses. For many M-DRG's, MAF is close to one and hence adjusting for it has little effect, however MAF is larger than 2 for a number of M-DRG's. The usual Chi-square statistic for these M-DRG's will be more than twice as large as it should be, resulting in anti-conservative tests of the null hypothesis of no excess variation.

INTRODUCTION

Small area variation analyses examine the variation in health care utilization, such as hospital admission rates, across small areas, such as counties. When estimating the amount of variation and testing whether the observed variation is greater than would be expected by chance, researchers often assume that the number of admissions within a county (and within a stratum) follow a Poisson distribution. However, if

it is possible for individuals to have more than one hospital admission in a year, then the Poisson assumption is probably violated. The within-county variance in the number of admissions will be greater than expected under the Poisson distribution and hence any hypothesis tests based on the Poisson assumption will be anti-conservative (Cain and Diehr, 1992; Diehr, Cain, Connell, et al., 1990).

We call the ratio of the true within-county variance to the Poisson variance the multiple admission factor or MAF (Cain and Diehr, 1992). If the number of admissions is known for each individual in the population, then quasi-likelihood methods (McCullagh and Nelder, 1989) can be used to account for this extra-Poisson variation. Such analyses simultaneously estimate the MAF and adjust for it. However, researchers often do not have access to individual-level data, but rather use aggregated data on the total number of admissions in a county or in strata within counties. In this situation it would be useful to have external estimates of MAF which can be used to adjust the analysis to account for the extra-Poisson variance (Cain and Diehr, 1992). In this paper we present data from Washington state to estimate the MAF for hospitalizations for a variety of M-DRG's and demonstrate how the MAF can be used in small area variational analyses.

ESTIMATES OF MAF

Data on all hospital discharges in the state of Washington for 1989 were obtained from the Washington State Department of Health Comprehensive Hospital Abstract Reporting System (CHARS). The data file contains an encrypted i.d. number based on date of birth, gender, the first two letters of the first name and the first two letters of the last name. It is thus possible to determine when multiple admissions belong to one individual. There are six border counties in Washington state whose residents are hospitalized out

of state a significant fraction of the time. Data from residents of these six counties have been excluded from all of our analyses.

Hospital discharges were classified according the modified Diagnostic Related Groups (M-DRG's) defined by Wennberg, McPherson and Caper (1984) and used by McMahon, Wolfe and Tedeschi (1989). Table 1 shows for each M-DRG the statewide mean admission rate per 1000 (m), the number of persons with at least one admission (n'), and the mean number of admissions per person among those with at least one admission (m'). The last two columns of Table 1 show the estimate MAF for each M-DRG and the standard error of the estimate. The appendix gives details of how these estimates were obtained.

M-DRG 96, chemotherapy, has an MAF of 4.08, the largest by far. This is to be expected, since a course of chemotherapy will often require several hospitalizations. The mean number of admissions per person among those with at least one admissions is 2.45 in this M-DRG. Five other M-DRG's have MAF greater than 1.5: red blood cell disorders (M-DRG 95); other endocrine, nutritional, and metabolic disorders (78); psychosis (101); other hepatobiliary diagnoses (57); and adult bronchitis and asthma (21). These M-DRG's correspond to severe chronic diseases for which multiple admissions would be expected. Notice that the MAF is less than 1.25 for all of the M-DRGS corresponding to procedures, indicated by "P" in Table 1. The last line in Table 1 shows MAF for all hospitalization, excluding maternity.

We tested whether MAF was the same in all age and sex groups. In most cases MAF was similar across all age-sex strata. However, there were five M-DRG's with statistically significant variation which also appeared to follow a somewhat consistent pattern: In M-DRG 1 (Nervous system operations) MAF is higher in children aged 0-9 (approximately 1.4) than in persons older than age 9 (1.1 to 1.2); in M-DRG 68 (other musculoskeletal system diagnoses) MAF is higher in girls aged 5 to 19 (2.0) than in others (1.1

to 1.2); in DRG 78 (other endocrine, Nutritional, and metabolic diagnoses) MAF is 2.0 for ages less than 40 and 1.1 for those 40 or older; in DRG 95 (red blood cell disorders) MAF is 4.0 for ages less than 55 and 1.3 for those 55 or older; in DRG 96 (chemotherapy) MAF is 6.6 for ages 0-19, 4.0 for ages 20 to 64, and 3.1 for those 65 and older.

There may be a concern over whether these MAF numbers are applicable outside of Washington State. In order to address this issue, we obtained data on 5,948 hospitalizations at the Regenstrief Health Center in Indianapolis (Clem McDonald, M.D., personal communication) during a one year period. Table 2 shows the MAF's estimated from the Regenstrief data for those M-DRG's with at least 100 persons admitted. The similarity between these estimates and those from Washington State is encouraging, considering the very different data sources. Note that the MAF's for M-DRG 29 and M-DRG 104 are higher in the Regenstrief data than in the Washington State data, and the standard errors are larger than would be expected based on the Washington State data. In both of these M-DRGs, there are two individuals with 8 or 9 admissions. These outliers have a large input on the MAF estimates.

ILLUSTRATIONS OF THE USE OF THE MAF

In order to illustrate the use of MAF we now present some small area variational analyses for the 33 non-border counties in Washington state. Seven M-DRGs have been selected, covering a range of MAF values and incidence rates: Heart failure and shock (M-DRG 29); GI obstruction (51); Minor skin disorders (73); Adult diabetes (76); Red blood cell disorders (95); Chemotherapy (96); and Psychosis (101).

We first consider the test of the null hypothesis that the true admission rate does not vary across counties. Cain and Diehr (1992) show that a valid test can be produced by first calculating the usual chi-square test statistic

$$X^2 = \sum_{j=1}^{J}(Y_j - E_j)/E_j,$$

where Y_j is the observed number of admissions in county j and E_j is the expected number, perhaps based on age-sex stratification. X^2 is then divided by MAF and this resulting statistic is compared to a table of the chi-square distribution with J-1 degrees of freedom.

Table 3 shows unadjusted and adjusted chi-square statistics for the seven selected M-DRGs. There are drastic changes in the chi-square statistic for some of the M-DRGs, although there are actually none in which adjustment for MAF causes a significant result to become non-significant.

MAF can also be incorporated into estimates of the variability in admission rates across counties. We will measure variability by the parameter τ, defined as the standard deviation of true rates across counties divided by the mean admission rate. τ can be thought of as the 'true coefficient of variation', where 'true' refers to the fact that only the true between-county variance is included, not the within-county variance (τ is denoted "CVA" in Diehr, Cain, Ye, et al., 1992). Define

$$SCV_{MAF} = [\,\Sigma_{j=1}^{J}(Y_j - E_j)^2/E_j^2 - \Sigma_{j=1}^{J}MAF/E_j\,]/J.$$

SCV_{MAF} is a modified version of the systematic component of variation (SCV), proposed by McPherson, Weinberg, Hovind, et al. (1982) as an estimator of τ^2. The modification consists of merely replacing $1/E_j$ with MAF/E_j.

Table 3 shows the square root of SCV and SCV_{MAF}. Notice that adjusting for MAF has a big impact on SCV for two M-DRG's in particular: M-DRG 95, which has a large MAF, and M-DRG 73, which has a small MAF but is a very uncommon admission, having fewer than 5 expected admissions in 22 of the 33 counties.

As discussed by Cain, Raghunathan and Diehr (manuscript in preparation), SCV is not an efficient estimator because it gives the same weight to small counties in which the true admission rate is very poorly estimated as it does to large counties which give very accurate estimates of true admission rate. A change of one or two admissions in a very small county can have a very large impact on SCV. An alternative estimate of τ is $\hat{\tau}_1$, defined as

$$\hat{\tau}_1 = [\sum_{j=1}^{J} (Y_j - E_j)^2/E_j - \sum_{j=1}^{J} MAF]/T,$$

where $T = \sum_{j=1}^{J} E_j$ is the total number of admissions in the state. Note that $\hat{\tau}_1$ gives more weight to large counties compared to small counties. Table 2 also shows the estimates $\hat{\tau}_1$, both unadjusted and adjusted for MAF. Notice that adjustment for MAF has little impact on $\hat{\tau}_1$.

The MAF can be used to adjust the confidence interval for an estimated admission rate for a given county. For example, the observed admission rate for Walla Walla county is 1.70 per thousand for M-DRG 101,

Psychosis. Since the population of this county is 48796, the standard error of this estimate based on the Poisson assumption is the square root of 0.0017/48796, or 0.19 per thousand. This gives an approximate 95% confidence interval of 1.32 to 2.08 per thousand. However, the actual variance is 1.92 times the Poisson variance, so the correct standard error is the square root of 1.92 times 0.19, or 0.26. This give a 95% confidence interval of 1.17 to 2.23, considerably wider than that based on the Poisson distribution.

The MAF can also be used to make adjustments to a Poisson regression relating admission rates to county-level covariates. For example, suppose we wish to test whether there is a relationship between hospital beds per capita and admission rate for red blood cell disorders (M-DRG 95). Since such disorders are much more common among blacks, the analysis should be adjusted for the racial composition of the county. Let us first fit a Poisson regression model which includes hospital beds per capita, percent black, percent asian, and percent black squared. The results show a coefficient for beds per 100,000 of -0.083 with a standard error of 0.027, which is significantly different from zero (p=0.002). The residual deviance is 71.2. Comparing this to a chi-square distribution with 28 degrees of freedom gives p = 0.00001, which means that there is significant residual variation still left after controlling for the variables in the model.

The results cited above are correct only if the Poisson assumption is appropriate, which is definitely not the case here. However, the results can easily be adjusted for MAF. The coefficient estimates remain unchanged, but the standard errors should be multiplied by the square root of MAF. The standard error of the coefficient for beds per 100,000 becomes 0.043 so that the coefficient is no longer significantly different from zero (p=0.056). The goodness of fit test is modified by dividing the residual deviance by MAF, giving 71.2/2.61 = 27.3 which is not significant. This method of fitting a Poisson regression model and then using MAF to adjust the results is equivalent to using GLIM to fit a quasi-liklihood model with known scale parameter (McCullagh and Nelder, 1989). Also note that for admissions with a relatively

rare incidence rate (less than 1 per 100), a logistic regression gives virtually the same results as Poisson regression.

DISCUSSION

We have seen that MAF is quite large for some admission types corresponding to severe chronic diseases in which frequent multiple admissions would be expected. On the other hand, MAF is close to one for most M-DRG's corresponding to procedures and hence adjustment for MAF is not so important.

A simple adjustment to the Chi-square statistic (namely dividing it by MAF) allows one to account for MAF when testing the null hypothesis that there is no variation in true rates across counties. This adjustment will make the result less significant, which could cause a change in one's conclusions if the unadjusted Chi-square was only marginally significant.

Adjustment for MAF can make a large difference in SCV, but in general has little effect on $\hat{t}_1$. The reason for this is that MAF only affects the within-county variance, and $\hat{t}_1$ downweights the small counties in which within-county variance is more important than between-county variance. However, if all counties are small and/or m is small so that <u>all</u> E_js are small, then adjustment for MAF may have a large impact on $\hat{t}_1$ as well as on MAF.

REFERENCES

Baker R and Nelder JA. The GLIM System Release 3 Manual. Oxford: the Numerical Algorithms Group, 1978.

Cain K, Diehr P. Testing the null hypothesis in small area analysis. *Health Services Research* 27:267-294, 1992.

Diehr P, Cain K, Connell F, Volinn E. What is too much variation? The null hypothesis in small-area analysis. *Health Services Research* 24/6:741-71, 1990.

Diehr P, Cain K, Ye Z, Abdul-Salam F. Small area variation analysis: methods for comparing several DRG's. *Medical Care* (in press).

Johnson NL and Kotz S. Discrete Distributions. Boston: Houghton Mifflin, 1969.

McCullagh P and Nelder JA. Generalized linear models. Generalized Linear Models, Second Edition, New York: Chapman and Hall, 1989.

McMahon LF, Wolfe RA, Tedeschi PJ. Variation in hospital admissions among small areas: A comparison of Main and Michigan. *Medical Care* 27/6: 623-31, June 1989.

McPherson K, Wennberg J, Hovind O, Clifford P. Small-area variations in the use of common surgical procedures: An International Comparison of New England, England and Norway. *New England Journal of Medicine* **307**/21:1310-14, 1982.

Mood AM, Graybill FA, Boes DC. Introduction to the Theory of Statistics. New York: McGraw-Hill, 1974.

Washington State Department of Health. Comprehensive Hospital Abstract Reporting System (CHARS), 1986.

Wennberg JE, McPherson K, Caper P. Will pament based on diagnosis-related groups control hospital costs? *New England Journla of Medicine* **311**/5:295-300, August 2, 1984.

Table 1: Estimates of the Multiple Admission Factor (MAF) by M-DRG.

M-DRG	m	n′	m′	MAF	(s.e.)		Description of M-DRG
1	108.	4363	1.08	1.18	(0.01)	P	NERVOUS SYSTEM OPERATIONS
2	137.	5689	1.06	1.12	(0.01)		SPECIFIC CEREBROVASCULAR DISORDERS
3	39.	1646	1.05	1.12	(0.03)		TRANSIENT ISCHEMIC ATTACKS
4	74.	2858	1.13	1.33	(0.03)		SEIZURES AND HEADACHES
5	141.	5717	1.08	1.22	(0.04)		OTHER NERVOUS SYSTEM DISORDERS
6	2.	91	1.03	1.06	(0.04)	P	LENS OPERATIONS
7	3.	120	1.03	1.06	(0.03)	P	EXRA OCULAR OPERATIONS
8	31.	1265	1.09	1.18	(0.02)	P	OTHER OPERATIONS ON THE EYE
9	8.	320	1.03	1.07	(0.03)	P	MISC. EAR, EYE, AND THROAT OPERATIONS
10	5.	219	1.00	1.00	(0.02)	P	OTHER T & A OPERATIONS
11	5.	204	1.00	1.00	(0.02)	P	TONSILLECTOMIE
12	63.	2711	1.02	1.05	(0.01)	P	OTHER EAR, EYE, AND THROAT OPERATIONS
13	18.	763	1.01	1.02	(0.01)		ADULT OTITIS MEDIA AND URI
14	16.	667	1.02	1.07	(0.03)		PEDIATRIC OTITIS MEDIA AND URI
15	56.	2336	1.05	1.12	(0.01)		OTHER EAR, EYE, AND THROAT DIAGNOSES
16	49.	2077	1.04	1.10	(0.01)	P	RESPIRATORY SYSTEM OPERATIONS
17	43.	1552	1.22	1.45	(0.03)		RESPIRATORY NEOPLASMS
18	63.	2313	1.20	1.47	(0.04)		CHRONIC OBSTRUCTIVE LUNG DISEASE
19	187.	7762	1.06	1.13	(0.01)		ADULT SIMPLE PNEUMONIA
20	47.	1920	1.07	1.16	(0.02)		PEDIATRIC PNEUMONIA
21	115.	4292	1.17	1.50	(0.05)		ADULT BRONCHITIS AND ASTHMA
22	68.	2613	1.14	1.36	(0.04)		PEDIATRIC BRONCHITIS AND ASTHMA
23	34.	1463	1.03	1.06	(0.01)		RESPIRATORY SIGNS AND SYMPTOMS
24	157.	6235	1.10	1.23	(0.01)		OTHER RESPIRATORY SYSTEM DIAGNOSES
25	191.	8124	1.03	1.06	(0.00)	P	MAJOR CARDIOVASCULAR OPERATIONS
26	157.	6204	1.11	1.23	(0.01)	P	OTHER CARDIOVASCULAR OPERATIONS
27	168.	6517	1.13	1.26	(0.01)		ACUTE MYOCARDIA INFARCTION
28	112.	4734	1.03	1.08	(0.01)		CIRCULATORY DISORDERS EXC. AMI, WITH CARD CATH
29	182.	6597	1.21	1.49	(0.02)		HEART FAILURE AND SHOCK
30	12.	526	1.03	1.07	(0.02)		DEEP VEIN THROMBOPHLEBITIS
31	43.	1797	1.05	1.10	(0.01)		PERIPHERAL VASCULAR DISORDERS
32	7.	311	1.04	1.10	(0.04)		ATHEROSCLEROSIS
33	10.	398	1.07	1.19	(0.07)		HYPERTENSION
34	132.	5163	1.12	1.30	(0.02)		CARDIAC ARRYTHMIAS
35	137.	5376	1.12	1.34	(0.05)		ANGINA PECTORIS
36	44.	1873	1.03	1.06	(0.01)		SYNCOPE AND COLLAPSE
37	126.	5313	1.04	1.10	(0.01)		CHEST PAIN
38	47.	1917	1.08	1.17	(0.02)		OTHER CIRCULATORY SYSTEM DISORDERS
39	107.	4501	1.04	1.09	(0.01)	P	MAJOR SMALL AND LARGE BOWEL OPERATOINS
40	55.	2347	1.03	1.07	(0.01)	P	STOMACH,ESOPHAGEAL, AND DUODENAL OPERATIONS

Table 1 (Continued).

41	20.	873	1.03	1.06	(0.01)	P	ANAL OPERATIONS
42	20.	877	1.01	1.02	(0.01)	P	OTHER ADULT HERNIA OPERATIONS
43	15.	633	1.01	1.02	(0.01)	P	INGUINAL AND FEMORAL HERNIA OPERATIONS
44	5.	204	1.02	1.04	(0.02)	P	PEDIATRIC HERNIA OPERATIONS
45	93.	4086	1.00	1.01	(0.00)	P	APPENDICITIS WITH APPENDECTOMY
46	2.	81	1.00	1.00	(0.05)		DENTAL EXTRACTIONS AND RESTORATIONS
47	55.	2365	1.02	1.04	(0.01)	P	OTHER DIGESTIVE DISEASE OPERATIONS
48	19.	724	1.17	1.34	(0.04)		DIGESTIVE MALIGNANCY
49	104.	4241	1.07	1.17	(0.02)		GASTRO-INTESTINAL HEMORRHAGE
50	18.	783	1.02	1.05	(0.01)		PEPTIC ULCER
51	54.	2128	1.11	1.27	(0.03)		GI OBSTRUCTION
52	226.	9297	1.06	1.15	(0.01)		ADULT GASTROENTERITIS
53	40.	1638	1.06	1.15	(0.02)		PEDIATRIC GASTROENTERITIS
54	59.	2436	1.06	1.18	(0.03)		OTHER DIGESTIVE DISEASE DIAGNOSES
55	178.	7787	1.00	1.01	(0.00)	P	GALL BLADDER DISEASE WITH CHOLECYSTECTOMY
56	34.	1357	1.09	1.19	(0.02)		DISORDERS OF THE BILIARY TRACT
57	86.	3108	1.21	1.57	(0.05)		OTHER HEPATOBILIARY SYSTEM DIAGNOSES
58	145.	6086	1.04	1.08	(0.00)	P	MAJOR JOINT OPERATIONS
59	75.	3224	1.02	1.05	(0.01)	P	HIP REPAIR EXCEPT JOINT REPLACEMENT
60	184.	7817	1.03	1.06	(0.00)	P	BACK AND NECK OPERATIONS
61	65.	2796	1.02	1.04	(0.01)	P	KNEE OPERATIONS
62	23.	999	1.02	1.04	(0.01)	P	FOOT OPERATIONS
63	31.	1340	1.01	1.02	(0.01)	P	SOFT TISSUE OPERATIONS
64	10.	415	1.00	1.01	(0.01)	P	HAND OPERATIONS EXCEPT GANGLION
65	276.	11625	1.04	1.09	(0.00)	P	OTHER MUSCULOSKELETAL SYSTEM OPERATIONS
66	79.	3288	1.05	1.11	(0.02)		MEDICAL BACK PROBLEMS
67	27.	1169	1.01	1.03	(0.01)		MISC. INJURIES TO EXTREMITIES
68	135.	5489	1.08	1.22	(0.02)		OTHER MUSCULOSKELETAL SYSTEM DIAGNOSES
69	1.	37	1.00	1.00	(0.10)	P	BREAST BIOPSY AND LOCAL EXCISIONS FOR NON-MALIGNA
70	114.	4821	1.04	1.08	(0.01)	P	OTHER SKIN, BREAST, SUBCUT. TISSUE OPERATIONS
71	72.	2979	1.06	1.13	(0.01)		CELLULITIS
72	23.	992	1.01	1.03	(0.01)		TRAUMA TO SKIN, SUBCUT. TISSUE, AND BREAST
73	7.	309	1.03	1.06	(0.02)		MINOR SKIN DISORDERS
74	17.	698	1.06	1.12	(0.02)		OTHER SKIN, BREAST, SUBCUT. TISSUE DIAGNOSES
75	34.	1446	1.03	1.05	(0.01)	P	ENDOCRINE, NUTRITIONAL, AND METABOLIC OPERATIONS
76	35.	1363	1.11	1.37	(0.08)		ADULT DIABETES
77	96.	3853	1.09	1.34	(0.11)		NUTRITIONAL AND METABOLIC DESEASES
78	56.	1931	1.27	2.07	(0.15)		OTHER ENDOCRINE, NUTRITIONAL, AND METABOLIC DIAG.
79	181.	7702	1.03	1.07	(0.00)	P	MAJOR GENITO-URINARY TRACT OPERATIONS
80	52.	2179	1.04	1.08	(0.01)	P	MINOR GENITO-URINARY TRACT OPERATIONS

Table 1 (Continued)

81	34.	1387	1.06	1.12	(0.02)	P	TRANSURETHRAL OPERATIONS
82	70.	2897	1.06	1.15	(0.02)		KIDNEY AND URINARY TRACT INFECTIONS
83	49.	1987	1.08	1.17	(0.02)		URINARY TRACT STONES
84	65.	2554	1.11	1.26	(0.02)		OTHER KIDNEY AND URINARY TRACT DIAGNOSES
85	13.	526	1.06	1.16	(0.04)		OTHER MALE REPORDUCTIVE SYSTEM DIAGNOSES
86	20.	881	1.00	1.00	(0.00)	P	HYSTERECTOMY
87	49.	2105	1.01	1.03	(0.00)	P	FEMALE REPRODUCTIVE SYSTEM RECONSTRUCTION OPER.
88	60.	2636	1.00	1.01	(0.00)	P	UTERUS AND ADENEXA OPERATIONS
89	211.	9172	1.01	1.02	(0.00)	P	TUBAL INTERRUPTION FOR NON-MALIGNANCY
90	8.	330	1.00	1.01	(0.01)	P	OTHER FEMALE LAPAROSCOPIC OPERATIONS
91	1.	23	1.00	1.00	(0.16)	P	LAPAROSCOPIC TUBAL INTERRUPTIONS
92	4.	154	1.01	1.01	(0.01)	P	D & C CONIZATION EXCEPT FOR MALIGNANCY
93	25.	1032	1.07	1.13	(0.02)	P	OTHER FEMALE REPRODUCTIVE SYSTEM OPERATIONS
94	38.	1555	1.06	1.12	(0.01)		FEMALE REPRODUCTIVE SYSTEM DIAGNOSES
95	32.	1048	1.33	2.61	(0.28)		RED BLOOD CELL DISORDERS
96	119.	2126	2.45	4.08	(0.12)		CHEMOTHERAPY
97	38.	1385	1.20	1.43	(0.04)		OTHER MYELOPROLIFERATIVE DISORDER DIAGNOSES
98	129.	5352	1.06	1.13	(0.01)		INFECTIOUS DISEASE DISORDERS
99	19.	786	1.05	1.10	(0.02)		ACUTE ADJUSTMENT REACTION
100	47.	1905	1.07	1.17	(0.02)		DEPRESSIVE NEUROSIS
101	267.	8656	1.35	1.92	(0.06)		PSYCHOSIS
102	67.	2671	1.10	1.25	(0.02)		OTHER MENTAL DISORDERS
103	0.	0	1.00	1.00	(1.00)		ORGANIC MENTAL SYNDROMES
104	197.	7381	1.17	1.37	(0.01)		OTHER SUBSTANCE USE
105	61.	2450	1.08	1.20	(0.02)	P	OPERATIONS FOR INJURIES
106	57.	2379	1.04	1.09	(0.01)		TOXIC EFFECTS OF DRUGS
107	65.	2766	1.03	1.08	(0.01)		OTHER INJURIES, POISONING, TOXIC EFFECT DIAG.
108	6.	279	1.01	1.03	(0.01)	P	OR PROCEDURE WITH "OTHER CONTACTS"
109	129.	5165	1.09	1.19	(0.01)		OTHER FACTORS INFLUENCING HEALTH STATUS
110	85.	3554	1.05	1.12	(0.01)	P	OTHER SURGICAL CAUSES
111	56.	2255	1.09	1.23	(0.03)		OTHER MEDICAL CAUSES
112	100.	4298	1.02	1.04	(0.01)		MISC. DRG'S (#468, #469, #470)
ALL	7887.	252989	1.36	2.13	(0.01)		ALL HOSPITALIZATIONS EXCEPT MATERNITY

M-DRG = Modified DRG, as defined by Wennberg, McPherson and Caper (1984);
m = Statewide admission rate per 100,000;
n′ = number of persons with one or more admissions;
m′ = mean admissions per person, among those with one or more admission;
S.E. = standard error of the estimated MAF (see appendix);
P indicates that this M-DRG corresponds to a procedure, rather than being a medical M-DRG.

Table 2: Comparison of MAF estimates from the Regenstrief Institute with those from Washington state

M-DRG	Regenstrief			Washington State		
	n	MAF	(S.E.)	n	MAF	(S.E.)
19	369	1.15	(0.03)	7762	1.13	(.01)
21	228	2.20	(0.24)	4292	1.50	(.05)
24	246	1.26	(0.09)	6235	1.23	(.01)
27	124	1.30	(0.08)	6517	1.26	(.01)
28	103	1.07	(0.04)	4734	1.08	(.01)
29	286	1.89	(0.23)	6597	1.49	(.02)
34	108	1.26	(0.11)	5163	1.30	(.02)
37	149	1.05	(0.03)	5313	1.10	(.01)
49	116	1.07	(0.03)	4241	1.17	(.02)
52	159	1.12	(0.05)	9297	1.15	(.01)
57	228	1.96	(0.19)	3108	1.57	(.05)
68	101	1.11	(0.04)	5489	1.22	(.02)
71	104	1.19	(0.12)	2979	1.13	(.01)
76	160	1.30	(0.09)	1363	1.37	(.08)
77	275	1.27	(0.07)	3853	1.34	(.11)
82	215	1.19	(0.09)	2897	1.15	(.02)
84	128	1.31	(0.10)	2554	1.26	(.02)
104	121	1.93	(0.49)	7381	1.37	(.01)
106	131	1.10	(0.06)	2379	1.09	(.01)
ALL	4050	2.30	(0.07)		2.13	(.01)

Table 3: Examples of using MAF to adjust the Chi-Square test statistic and two measures of variability.

			Assume Poisson (MAF=1)			Adjust for MAF			
M-DRG	MAF	m	Chi-Sq	$\sqrt{SCV}$	$\hat{t}_1$	Chi-Sq	$\sqrt{SCV}$	$\hat{t}_1$	nsmall
29	1.49	182.	282.5	0.29	0.19	189.9	0.27	0.19	0
51	1.27	54.	79.9	0.18	0.15	62.8	0.10	0.14	3
73	1.06	7.	43.9	0.17	0.21	41.5	-0.07	0.19	22
76	1.37	35.	160.1	0.54	0.32	116.9	0.49	0.30	7
95	2.62	32	200.0	0.36	0.38	76.4	-0.31	0.31	7
96	4.08	119.	927.5	0.51	0.45	227.3	0.39	0.42	1
101	1.92	267.	854.9	0.40	0.29	446.4	0.38	0.28	0

m = admission rate per 100,000;

Chi-Sq = the Chi-square test statistic;

SCV = Systematic Component of Variation;

$\hat{t}_1$ = alternative estimator of variation which gives more weight to large counties relative to small counties.

nsmall = number of counties with expected number of admissions less than 5.

Appendix:

Estimating the multiple admission factor (MAF)

Consider a homogeneous population, in which the admission rate does not differ across age or sex or area. Define:

y_i = number of admissions for person i,

m = $E(y_i)$,

v = $Var(y_i)$, and

MAF = v/m

Since the variance of y_i is equal to m if y_i has a Poisson distribution, MAF is the ratio of the actual to the Poisson variance.

Let us now consider just those persons who had one or more admissions. Define:

p = $Pr\ (y_i > 0)$,

m' = $E(y_i | y_i > 0)$,

v' = $Var(y_i | y_i > 0)$

The formula relating conditional and unconditional variances is used to show that MAF can be written as

$$\text{MAF} = v'/m' + m'(1-p)$$

$$\approx v'/m' + m'.$$

This relationship also holds for the estimated means and variance.

$$\hat{\text{MAF}} = \hat{v}/\hat{m} \approx \hat{v}'/\hat{m}' + \hat{m}', \tag{A1}$$

where the usual sample means and variances are used, except that n' (the number of persons with 1 or more admissions) is used in the denominator of $\hat{v}'$, rather than $(n'-1)$:

$$\hat{v}' = \frac{\Sigma(y_i - \hat{m}')^2}{n'},$$

where the sum is over all persons with one or more admissions.

Since $p < .01$ for all M-DRG's considered here, the approximation which assumes $p = 0$ will be quite good and will be used in all that follows. This approximation is very useful in that one can estimate MAF using only data on persons with hospital admissions, without needing accurate estimates of the size of the population. It also shows how MAF can be fairly constant across strata even though the admission rate m varies, if the variation across strata is due to variation in p but not m' or v'.

We used the jackknife to obtain standard errors for the MAF estimates. The jackknife estimates the standard error by calculating how much $\hat{\text{MAF}}$ changes if one observation is left out. This process breaks down if no person has more than one admission. In this case, $m' = 1$ and $v' = 0$, and these do not change if one observation is removed. Thus the jackknife estimate of standard error is zero. We therefore used an alternative procedure for obtaining errors in this case. This alternative method involves inventing

a likelihood ratio test based on the Bernoulli-Poisson mixture distribution (Cain and Diehr, 1992, Johnson and Kotz, 1969) to determine the largest value of MAF which is consistent with the observed data.

We estimated MAF by two methods. First, we used data from all admissions (pooled across counties and age-sex strata) to estimate m' and v' and then used (A1) to calculate MÂF. Secondly, we stratified the data into 36 age-sex strata, calculated $\hat{m}'$, $\hat{v}'$, and MÂF within each stratum, and then took a weighted average (weighted by n') of these MAF estimates to get the overall MÂF. This second method is similar to using GLIM [REF] to estimate the scale parameter in a extra-Poisson regression model which includes stratum as a factor (McCullagh and Nelder, 1989), the only difference being that the GLIM estimate is a weighted average using the population of the stratum as the weight, rather than the number of persons with one or more admissions. The stratified and unstratified estimates are very similar, and Table 1 presents only the unstratified estimates.

APPENDIX 2. Estimates of MAF for individual DRG's.

m = admission rate per 100,000.
m' = mean number of admissions, among those with at least one admission.
s' = standard deviation of number of admissions, among those with at least one admission.
MAF = Multipe Admission Factor.

DRG	DESCRIPTION	m	m'	s'	MAF
1	Craniotomy Age > 18 Except For Trauma	25.90	1.090	.332	1.190
2	Craniotomy For Trauma Age > 18	9.82	1.010	.100	1.030
3	Craniotomy Age <18	8.51	1.170	.510	1.390
4	Spinal Procedures	10.41	1.050	.245	1.110
5	Extracranial Vascular Procedures	34.06	1.080	.283	1.150
6	Carpal Tunnel Release	2.23	1.020	.141	1.040
7	Periph & Cranial Nerv & Other Nerv Sys P	3.73	1.020	.141	1.030
8	Periph & Cranial Nerv & Other Nerv Sys P	6.97	1.030	.173	1.050
9	Spinal Disorders & Injuries	2.18	1.060	.245	1.110
10	Nervous System Neoplasms Age > 70 And/Or	14.65	1.160	.424	1.310
11	Nervous System Neoplasms Age <70 W/O C.C	4.19	1.160	.458	1.340
12	Degenerative Nervous System Disorders	12.35	1.080	.332	1.180
13	Multiple Sclerosis & Cerebellar Ataxia	5.47	1.170	.539	1.420
14	Specific Cerebrovascular Disorders Excep	130.07	1.060	.265	1.120
15	Transient Ischemic Attacks	43.94	1.030	.173	1.070
16	Nonspecific Cerebrovascular Disorders Wi	4.54	1.010	.100	1.030
17	Nonspecific Cerebrovascular Disorders W/	1.94	1.020	.141	1.040
18	Cranial & Peripheral Nerve Disorders Age	8.89	1.110	.469	1.310
19	Cranial & Peripheral Nerve Disorders Age	8.29	1.080	.412	1.240
20	Nervous System Infection Except Viral Me	11.96	1.070	.265	1.140
21	Viral Meningitis	11.23	1.020	.141	1.040
22	Hypertensive Encephalopathy	4.43	1.020	.141	1.040
23	Nontraumatic Stupor & Coma	3.68	1.010	.141	1.030
24	Seizure & Headache Age > 70 And/Or C.C.	33.90	1.090	.361	1.210
25	Seizure & Headache Age 18-69 W/O C.C.	29.12	1.110	.412	1.260
26	Seizure & Headache Age 0-17	16.39	1.130	.480	1.330
27	Traumatic Stupor & Coma, Coma >1 Hr	6.11	1.010	.100	1.030
28	Traumatic Stupor & Coma, Coma <1 Hr Age	7.70	1.020	.141	1.050
29	Traumatic Stupor & Coma <1 Hr Age 18-69	4.06	1.010	.100	1.020
30	Traumatic Stupor & Coma <1 Hr Age 0-17	7.81	1.030	.173	1.060
31	Concussion Age > 70 And/Or C.C.	4.83	1.000	.000	1.000
32	Concussion Age 18-69 W/O C.C.	6.35	1.010	.100	1.020
33	Concussion Age 0-17	5.96	1.000	.000	1.010
34	Other Disorders Of Nervous System Age >	11.43	1.030	.200	1.060
35	Other Disorders Of Nervous System Age <7	5.56	1.030	.200	1.070
36	Retinal Procedures	17.29	1.100	.361	1.210
37	Orbital Procedures	2.82	1.020	.141	1.040
38	Primary Iris Procedures	.51	1.090	.300	1.170
39	Lens Procedures	2.62	1.020	.141	1.050
40	Extraocular Procedures Except Orbit Age	2.34	1.000	.000	1.000
41	Extraocular Procedures Except Orbit Age	.75	1.000	.000	1.000
42	Intraocular Procedures Except Retina, Ir	13.99	1.050	.245	1.100
43	Hyphema	1.39	1.020	.141	1.030

APPENDIX 2 (continued)

44 Acute Major Eye Infections	5.25	1.020	.141	1.030
45 Neurological Eye Disorders	1.99	1.000	.000	1.000
46 Other Disorders Of The Eye Age > 18 With	2.23	1.060	.283	1.130
47 Other Disorders Of The Eye Age > 18 W/O	2.96	1.000	.000	1.000
48 Other Disorders Of The Eye Age 0-17	1.04	1.000	.000	1.000
49 Major Head & Neck Procedures	4.26	1.020	.100	1.030
50 Sialoadenectomy	6.57	1.000	.000	1.010
51 Salivary Gland Procedures Except Siaload	.82	1.000	.000	1.000
52 Cleft Lip & Palate Repair	4.43	1.100	.374	1.230
53 Sinus & Mastoid Procedures Age > 18	15.35	1.020	.141	1.040
54 Sinus & Mastoid Procedures Age 0-17	2.01	1.010	.100	1.020
55 Miscellaneous Ear, Nose & Throat Procedu	10.85	1.040	.265	1.110
56 Rhinoplasty	3.26	1.010	.100	1.010
57 T&A Proc Except Tonsillectomy &/Or Adeno	1.72	1.000	.000	1.000
58 T&A Proc Except Tonsillectomy &/Or Adeno	2.56	1.000	.000	1.000
59 Tonsillectomy And/Or Adenoidectomy Age >	2.56	1.000	.000	1.000
60 Tonsillectomy And/Or Adenoidectomy Age 0	3.86	1.000	.000	1.000
61 Myringotomy Age > 18	.04	1.000	.000	1.000
62 Myringotomy Age 0-17	1.92	1.010	.100	1.020
63 Other Ear, Nose & Throat O.R. Procedures	4.04	1.030	.173	1.050
64 Ear, Nose & Throat Malignancy	2.85	1.190	.436	1.360
65 Dysequilibrium	17.18	1.020	.141	1.040
66 Epistaxis	6.20	1.040	.224	1.090
67 Epiglottitis	2.01	1.080	.316	1.170
68 Otitis Media & Uri Age > 70 And/Or C.C.	10.08	1.020	.141	1.040
69 Otitis Media & Uri Age 18-69 W/O C.C.	8.05	1.020	.141	1.040
70 Otitis Media & Uri Age 0-17	17.45	1.030	.173	1.050
71 Laryngotracheitis	15.51	1.040	.224	1.080
72 Nasal Trauma & Deformity	1.50	1.000	.000	1.000
73 Other Ear, Nose & Throat Diagnoses Age >	8.34	1.020	.141	1.050
74 Other Ear, Nose & Throat Diagnoses Age 0	3.62	1.050	.265	1.120
75 Major Chest Procedures	28.72	1.010	.100	1.030
76 O.R. Proc On The Resp System Except Majo	6.95	1.020	.141	1.040
77 O.R. Proc On The Resp System Except Majo	2.49	1.020	.141	1.030
78 Pulmonary Embolism	15.44	1.050	.224	1.100
79 Respiratory Infections & Inflammations A	41.82	1.110	.387	1.240
80 Respiratory Infections & Inflammations A	2.87	1.040	.200	1.070
81 Respiratory Infections & Inflammations A	3.33	1.200	.529	1.430
82 Respiratory Neoplasms	44.69	1.220	.529	1.450
83 Major Chest Trauma Age > 70 And/Or C.C.	6.55	1.000	.000	1.010
84 Major Chest Trauma Age <70 W/O C.C.	1.90	1.000	.000	1.000
85 Pleural Effusion Age > 70 And/Or C.C.	6.51	1.060	.300	1.140
86 Pleural Effusion Age <70 W/O C.C.	.79	1.000	.000	1.000
87 Pulmonary Edema & Respiratory Failure	24.53	1.070	.316	1.160
88 Chronic Obstructive Pulmonary Disease	56.62	1.230	.608	1.540
89 Simple Pneumonia & Pleurisy Age > 70 And	135.54	1.060	.300	1.140
90 Simple Pneumonia & Pleurisy Age 18-69 W/	23.12	1.010	.100	1.030
91 Simple Pneumonia & Pleurisy Age 0-17	40.67	1.070	.316	1.160
92 Interstitial Lung Disease Age > 70 And/O	5.62	1.110	.361	1.230
93 Interstitial Lung Disease Age <70 W/O C.	1.54	1.110	.400	1.260
94 Pneumothorax Age > 70 And/Or C.C.	8.36	1.060	.283	1.130
95 Pneumothorax Age <70 W/O C.C.	7.90	1.070	.283	1.140
96 Bronchitis & Asthma Age > 70 And/Or C.C.	80.73	1.170	.557	1.440
97 Bronchitis & Asthma Age 18-69 W/O C.C.	35.29	1.160	.574	1.450

98	Bronchitis & Asthma Age 0-17	59.51	1.180	.656	1.540
99	Respiratory Signs & Symptoms Age > 70 An	17.95	1.030	.173	1.050
100	Respiratory Signs & Symptoms Age <70 W/O	14.25	1.030	.224	1.080
101	Other Respiratory Diagnoses Age > 70 And	13.41	1.010	.100	1.020
102	Other Respiratory Diagnoses Age <70	5.16	1.030	.224	1.080
103	Heart Transplant	.22	1.000	.000	1.000
104	Cardiac Valve Procedure With Pump & With	6.60	1.000	.000	1.010
105	Cardiac Valve Procedure With Pump & W/O	14.87	1.000	.000	1.010
106	Coronary Bypass With Cardiac Cath	37.50	1.000	.000	1.000
107	Coronary Bypass W/O Cardiac Cath	50.93	1.000	.000	1.000
108	Cardiothor Proc,Except Valve & Coronary	4.61	1.000	.000	1.010
109	Cardiothoracic Procedures W/O Pump	9.44	1.010	.100	1.030
110	Major Reconstructive Vascular Procedures	39.62	1.020	.141	1.040
111	Major Reconstructive Vascular Procedures	7.90	1.030	.173	1.060
112	Vascular Procedures Except Major Reconst	74.71	1.100	.332	1.200
113	Amputation For Circ System Disorders Exc	9.20	1.050	.224	1.100
114	Upper Limb & Toe Amputation For Circ Sys	3.11	1.050	.245	1.110
115	Permanent Cardiac Pacemaker Implant With	1.57	1.000	.000	1.000
116	Permanent Cardiac Pacemaker Implant W/O	16.87	1.010	.100	1.020
117	Cardiac Pacemaker Replace & Revis Exc Pu	4.32	1.030	.245	1.100
118	Cardiac Pacemaker Pulse Generator Replac	2.01	1.000	.000	1.000
119	Vein Ligation & Stripping	8.01	1.010	.100	1.030
120	Other O.R. Procedures On The Circulatory	6.55	1.070	.265	1.140
121	Circulatory Disorders With Ami & C.V. Co	58.58	1.070	.300	1.150
122	Circulatory Disorders With Ami W/O C.V.	75.17	1.060	.245	1.110
123	Circulatory Disorders With Ami, Expired	21.95	1.000	.000	1.000
124	Circulatory Disorders Exc Ami,With Card	49.14	1.040	.224	1.080
125	Circulatory Disorders Exc Ami,With Card	72.08	1.010	.100	1.030
126	Acute & Subacute Endocarditis	4.24	1.130	.424	1.290
127	Heart Failure & Shock	171.78	1.210	.574	1.480
128	Deep Vein Thrombophlebitis	16.96	1.030	.173	1.050
129	Cardiac Arrest	4.70	1.000	.000	1.010
130	Peripheral Vascular Disorders Age > 70 A	29.25	1.040	.224	1.080
131	Peripheral Vascular Disorders Age <70 W/	11.98	1.030	.200	1.070
132	Atherosclerosis Age > 70 And/Or C.C.	6.66	1.040	.224	1.080
133	Atherosclerosis Age <70 W/O C.C.	1.99	1.010	.100	1.020
134	Hypertension	11.07	1.050	.245	1.100
135	Cardiac Congenital & Valvular Disorders	3.35	1.030	.173	1.060
136	Cardiac Congenital & Valvular Disorders	.84	1.000	.000	1.000
137	Cardiac Congenital & Valvular Disorders	1.81	1.090	.283	1.170
138	Cardiac Arrhythmia & Conduction Disorder	96.37	1.090	.374	1.220
139	Cardiac Arrhythmia & Conduction Disorder	24.95	1.060	.265	1.120
140	Angina Pectoris	137.64	1.120	.447	1.290
141	Syncope & Collapse Age > 70 And/Or C.C.	39.77	1.030	.173	1.060
142	Syncope & Collapse Age <70 W/O C.C.	10.08	1.030	.173	1.050
143	Chest Pain	115.14	1.040	.224	1.080
144	Other Circulatory Diagnoses With C.C.	20.69	1.050	.245	1.110
145	Other Circulatory Diagnoses W/O C.C.	8.25	1.020	.200	1.060
146	Rectal Resection Age > 70 And/Or C.C.	11.62	1.010	.100	1.020
147	Rectal Resection Age <70 W/O C.C.	2.76	1.020	.141	1.030
148	Major Small & Large Bowel Procedures Age	71.58	1.030	.173	1.060
149	Major Small & Large Bowel Procedures Age	16.96	1.010	.100	1.020
150	Peritoneal Adhesiolysis Age > 70 And/Or	11.25	1.010	.100	1.010
151	Peritoneal Adhesiolysis Age <70 W/O C.C.	6.57	1.020	.141	1.040

APPENDIX 2 (continued)

152	Minor Small & Large Bowel Procedures Age	5.82	1.010	.100	1.020
153	Minor Small & Large Bowel Procedures Age	3.07	1.000	.000	1.000
154	Stomach, Esophageal & Duodenal Procedure	34.23	1.030	.200	1.070
155	Stomach, Esophageal & Duodenal Procedure	8.56	1.000	.000	1.010
156	Stomach, Esophageal & Duodenal Procedure	4.87	1.020	.141	1.040
157	Anal Procedures Age > 70 And/Or C.C.	13.08	1.010	.100	1.020
158	Anal Procedures Age <70 W/O C.C.	15.04	1.020	.141	1.040
159	Hernia Procedures Except Inguinal & Femo	7.98	1.020	.141	1.040
160	Hernia Procedures Except Inguinal & Femo	10.39	1.010	.100	1.020
161	Inguinal & Femoral Hernia Procedures Age	9.40	1.010	.100	1.020
162	Inguinal & Femoral Hernia Procedures Age	9.07	1.000	.000	1.000
163	Hernia Procedures Age 0-17	5.03	1.010	.100	1.020
164	Appendectomy With Complicated Princ. Dia	7.92	1.000	.000	1.000
165	Appendectomy With Complicated Princ. Dia	16.17	1.000	.000	1.000
166	Appendectomy W/O Complicated Princ. Diag	6.71	1.000	.000	1.000
167	Appendectomy W/O Complicated Princ. Diag	56.58	1.000	.000	1.000
168	Procedures On The Mouth Age > 70 And/Or	9.15	1.010	.100	1.010
169	Procedures On The Mouth Age <70 W/O C.C.	23.09	1.010	.100	1.010
170	Other Digestive System Procedures Age >	8.67	1.010	.141	1.030
171	Other Digestive System Procedures Age <7	5.58	1.010	.100	1.010
172	Digestive Malignancy Age > 70 And/Or C.C	15.88	1.160	.447	1.330
173	Digestive Malignancy Age <70 W/O C.C.	1.52	1.080	.265	1.140
174	G.I. Hemorrhage Age > 70 And/Or C.C.	79.91	1.070	.316	1.160
175	G.I. Hemorrhage Age <70 W/O C.C.	14.71	1.020	.141	1.030
176	Complicated Peptic Ulcer	7.81	1.050	.224	1.090
177	Uncomplicated Peptic Ulcer Age > 70 And/	7.15	1.010	.100	1.020
178	Uncomplicated Peptic Ulcer Age <70 W/O C	4.59	1.030	.173	1.070
179	Inflammatory Bowel Disease	11.93	1.180	.624	1.520
180	G.I. Obstruction Age > 70 And/Or C.C.	31.89	1.100	.361	1.220
181	G.I. Obstruction Age <70 W/O C.C.	15.49	1.070	.265	1.140
182	Esophagitis,Gastroent.& Misc. Digest. Di	144.35	1.070	.316	1.160
183	Esophagitis,Gastroent.& Misc. Digest. Di	79.61	1.050	.245	1.100
184	Esophagitis, Gastroenteritis & Misc. Dig	42.44	1.060	.316	1.160
185	Dental & Oral Dis. Exc Extractions & Res	6.88	1.020	.100	1.030
186	Dental & Oral Dis. Exc Extractions & Res	2.38	1.000	.000	1.000
187	Dental Extractions & Restorations	1.72	1.000	.000	1.000
188	Other Digestive System Diagnoses Age > 7	18.70	1.040	.200	1.080
189	Other Digestive System Diagnoses Age 18-	11.82	1.010	.100	1.030
190	Other Digestive System Diagnoses Age 0-1	7.10	1.020	.141	1.040
191	Major Pancreas, Liver & Shunt Procedures	6.57	1.020	.141	1.030
192	Minor Pancreas, Liver & Shunt Procedures	2.05	1.050	.265	1.120
193	Biliary Tract Proc Exc Tot Cholecystecto	9.75	1.050	.224	1.100
194	Biliary Tract Proc Exc Tot Cholecystecto	2.89	1.060	.265	1.120
195	Total Cholecystectomy With C.D.E. Age >	16.19	1.000	.000	1.000
196	Total Cholecystectomy With C.D.E. Age <7	3.75	1.010	.100	1.010
197	Total Cholecystectomy W/O C.D.E. Age > 7	67.03	1.000	.000	1.000
198	TOTAL CHOLECYSTECTOMY W/O C.D.E. AGE <70	60.09	1.000	.000	1.000
199	Hepatobiliary Diagnostic Procedure For M	1.28	1.000	.000	1.000
200	Hepatobiliary Diagnostic Procedure For N	2.21	1.000	.000	1.000
201	Other Hepatobiliary Or Pancreas O.R. Pro	4.35	1.280	.640	1.610
202	Cirrhosis & Alcoholic Hepatitis	10.81	1.150	.458	1.330
203	Malignancy Of Hepatobiliary System Or Pa	14.38	1.140	.400	1.280
204	Disorders Of Pancreas Except Malignancy	31.50	1.240	.812	1.770
205	Disorders Of Liver Exc Malig,Cirr,Alc He	17.14	1.160	.648	1.530

APPENDIX 2 (continued)

206	Disorders Of Liver Exc Malig,Cirr,Alc He	5.32	1.050	.245	1.110
207	Disorders Of The Biliary Tract Age > 70	15.60	1.050	.283	1.130
208	Disorders Of The Biliary Tract Age <70 W	10.30	1.030	.224	1.080
209	Major Joint Procedures	125.00	1.040	.200	1.070
210	Hip & Femur Procedures Except Major Join	57.57	1.020	.141	1.040
211	Hip & Femur Procedures Except Major Join	11.34	1.020	.141	1.040
212	Hip & Femur Procedures Except Major Join	7.06	1.040	.224	1.090
213	Amputations For Musculoskeletal System &	4.04	1.070	.283	1.150
214	Back & Neck Procedures Age > 70 And/Or C	42.11	1.020	.141	1.030
215	Back & Neck Procedures Age <70 W/O C.C.	105.68	1.020	.173	1.050
216	Biopsies Of Musculoskeletal System & Con	4.26	1.010	.100	1.030
217	Wnd Debrid & Skn Grft Exc Hand,For Muscs	16.52	1.030	.200	1.060
218	Lower Extrem & Humer Proc Exc Hip,Foot,F	19.43	1.020	.141	1.040
219	Lower Extrem & Humer Proc Exc Hip,Foot,F	53.40	1.020	.141	1.040
220	Lower Extrem & Humer Proc Exc Hip,Foot,F	11.67	1.020	.173	1.050
221	Knee Procedures Age > 70 And/Or C.C.	5.62	1.000	.000	1.000
222	Knee Procedures Age <70 W/O C.C.	51.62	1.010	.100	1.020
223	Upper Extremity Proc Exc Humerus & Hand	40.19	1.020	.141	1.030
224	Upper Extremity Proc Exc Humerus & Hand	38.27	1.020	.141	1.040
225	Foot Procedures	29.56	1.020	.141	1.040
226	Soft Tissue Procedures Age > 70 And/Or C	6.31	1.010	.100	1.010
227	Soft Tissue Procedures Age <70 W/O C.C.	22.26	1.010	.100	1.020
228	Ganglion (Hand) Procedures	8.69	1.030	.173	1.050
229	Hand Procedures Except Ganglion	13.68	1.020	.141	1.040
230	Local Excision & Removal Of Int Fix Devi	7.96	1.010	.100	1.020
231	Local Excision & Removal Of Int Fix Devi	29.49	1.010	.100	1.020
232	Arthroscopy	3.29	1.000	.000	1.000
233	Other Musculoskelet Sys & Conn Tiss O.R.	6.99	1.010	.100	1.010
234	Other Musculoskelet Sys & Conn Tiss O.R.	13.52	1.010	.100	1.020
235	Fractures Of Femur	7.98	1.020	.141	1.040
236	Fractures Of Hip & Pelvis	21.79	1.020	.141	1.040
237	Sprains, Strains, & Dislocations Of Hip,	1.83	1.010	.100	1.020
238	Osteomyelitis	4.04	1.060	.265	1.130
239	Pathological Fractures & Musculoskeletal	27.90	1.100	.361	1.220
240	Connective Tissue Disorders Age > 70 And	7.41	1.120	.436	1.290
241	Connective Tissue Disorders Age <70 W/O	4.74	1.090	.300	1.180
242	Septic Arthritis	3.15	1.040	.200	1.080
243	Medical Back Problems	149.60	1.090	.436	1.260
244	Bone Diseases & Septic Arthropathy Age >	5.89	1.040	.224	1.080
245	Bone Diseases & Septic Arthropathy Age <	3.00	1.010	.100	1.030
246	Non-Specific Arthropathies	1.41	1.000	.000	1.000
247	Signs & Symptoms Of Musculoskeletal Syst	11.18	1.010	.100	1.020
248	Tendonitis, Myositis & Bursitis	6.95	1.010	.100	1.020
249	Aftercare, Musculoskeletal System & Conn	5.32	1.170	.500	1.380
250	Fx,Sprns,Strns & Disl Of Forearm,Hand,Fo	3.51	1.010	.100	1.010
251	Fx,Sprns,Strns & Disl Of Forearm,Hand,Fo	4.94	1.000	.000	1.010
252	Fx,Sprns,Strns & Disl Of Forearm,Hand,Fo	5.01	1.000	.000	1.000
253	Fx,Sprns,Strns & Disl Of Uparm,Lowleg Ex	14.29	1.010	.100	1.020
254	Fx,Sprns,Strns & Disl Of Uparm,Lowleg Ex	16.04	1.020	.141	1.030
255	Fx,Sprns,Strns & Disl Of Uparm,Lowleg Ex	8.05	1.010	.100	1.020
256	Other Diagnoses Of Musculoskeletal Syste	10.24	1.040	.200	1.080
257	Total Mastectomy For Malignancy Age > 70	26.01	1.010	.100	1.010
258	Total Mastectomy For Malignancy Age <70	16.68	1.010	.100	1.020
259	Subtotal Mastectomy For Malignancy Age >	3.44	1.010	.100	1.010

APPENDIX 2 (continued)

260	Subtotal Mastectomy For Malignancy Age <	3.86	1.010	.100	1.010
261	Breast Proc For Non-Malig Except Biopsy	19.12	1.020	.141	1.030
262	Breast Biopsy & Local Excision For Non-M	1.99	1.020	.141	1.040
263	Skin Grafts For Skin Ulcer Or Cellulitis	10.35	1.050	.224	1.100
264	Skin Grafts For Skin Ulcer Or Cellulitis	3.04	1.070	.245	1.130
265	Skin Grafts Except For Skin Ulcer Or Cel	3.99	1.030	.173	1.060
266	Skin Grafts Except For Skin Ulcer Or Cel	10.39	1.030	.173	1.060
267	Perianal & Pilonidal Procedures	1.26	1.020	.141	1.030
268	Skin,Subcutaneous Tissue & Breast Plasti	4.28	1.010	.100	1.020
269	Other Skin, Subcut Tiss & Breast O.R. Pr	7.61	1.020	.141	1.040
270	Other Skin, Subcut Tiss & Breast O.R. Pr	9.26	1.010	.100	1.030
271	Skin Ulcers	6.15	1.040	.200	1.080
272	Major Skin Disorders Age > 70 And/Or C.C	4.50	1.070	.332	1.180
273	Major Skin Disorders Age <70 W/O C.C.	2.03	1.020	.141	1.040
274	Malignant Breast Disorders Age > 70 And/	3.57	1.080	.300	1.160
275	Malignant Breast Disorders Age <70 W/O C	.79	1.060	.224	1.110
276	Non-Malignant Breast Disorders	2.07	1.010	.100	1.020
277	Cellulitis Age > 70 And/Or C.C.	36.29	1.070	.316	1.160
278	Cellulitis Age 18-69 W/O C.C.	23.91	1.030	.224	1.080
279	Cellulitis Age 0-17	8.47	1.050	.361	1.170
280	Trauma To The Skin, Subcut Tiss & Breast	13.85	1.010	.100	1.010
281	Trauma To The Skin, Subcut Tiss & Breast	9.88	1.000	.000	1.010
282	Trauma To The Skin, Subcut Tiss & Breast	3.33	1.010	.100	1.010
283	Minor Skin Disorders Age > 70 And/Or C.C	4.26	1.020	.173	1.040
284	Minor Skin Disorders Age <70 W/O C.C.	5.21	1.030	.173	1.070
285	Amputations For Endocrine,Nutritional &	1.63	1.010	.100	1.030
286	Adrenal & Pituitary Procedures	2.32	1.000	.000	1.000
287	Skin Grafts & Wound Debride For Endoc,Nu	2.43	1.040	.200	1.080
288	O.R. Procedures For Obesity	5.71	1.010	.141	1.020
289	Parathyroid Procedures	4.81	1.010	.100	1.020
290	Thyroid Procedures	13.50	1.010	.100	1.020
291	Thyroglossal Procedures	1.21	1.020	.141	1.040
292	Other Endocrine, Nutrit & Metab O.R. Pro	1.59	1.000	.000	1.000
293	Other Endocrine, Nutrit & Metab O.R. Pro	.29	1.000	.000	1.000
294	Diabetes Age > 36	35.91	1.110	.447	1.290
295	Diabetes Age 0-35	25.65	1.500#	1.752	3.550
296	Nutritional & Misc. Metabolic Disorders	75.92	1.060	.283	1.140
297	Nutritional & Misc. Metabolic Disorders	9.68	1.030	.173	1.060
298	Nutritional & Misc. Metabolic Disorders	18.02	1.090	.469	1.290
299	Inborn Errors Of Metabolism	1.83	1.410#	1.575	3.170
300	Endocrine Disorders Age > 70 And/Or C.C.	5.14	1.020	.141	1.050
301	Endocrine Disorders Age <70 W/O C.C.	2.43	1.020	.141	1.030
302	Kidney Transplant	2.74	1.000	.000	1.000
303	Kidney,Ureter & Major Bladder Procedure	9.79	1.020	.173	1.050
304	Kidney,Ureter & Maj Bldr Proc For Non-Ma	13.63	1.050	.224	1.090
305	Kidney,Ureter & Maj Bldr Proc For Non-Ma	10.94	1.050	.224	1.090
306	Prostatectomy Age > 70 And/Or C.C.	6.42	1.010	.100	1.020
307	Prostatectomy Age <70 W/O C.C.	1.70	1.010	.100	1.020
308	Minor Bladder Procedures Age > 70 And/Or	5.12	1.030	.200	1.070
309	Minor Bladder Procedures Age <70 W/O C.C	2.18	1.000	.000	1.000
310	Transurethral Procedures Age > 70 And/Or	20.27	1.070	.283	1.140
311	Transurethral Procedures Age <70 W/O C.C	14.56	1.020	.173	1.060
312	Urethral Procedures, Age > 70 And/Or C.C	1.50	1.010	.100	1.030
313	Urethral Procedures, Age 18-69 W/O C.C.	1.92	1.050	.224	1.090

APPENDIX 2 (continued)

314 Urethral Procedures, Age 0-17	.53	1.000	.000	1.000
315 Other Kidney & Urinary Tract O.R. Proced	10.59	1.060	.245	1.110
316 Renal Failure W/O Dialysis	14.07	1.090	.400	1.230
317 Renal Failure With Dialysis	.35	1.230	.831	1.790
318 Kidney & Urinary Tract Neoplasms Age > 7	4.08	1.130	.424	1.290
319 Kidney & Urinary Tract Neoplasms Age <70	.79	1.090	.374	1.220
320 Kidney & Urinary Tract Infections Age >	49.06	1.060	.283	1.130
321 Kidney & Urinary Tract Infections Age 18	20.23	1.030	.173	1.060
322 Kidney & Urinary Tract Infections Age 0-	11.63	1.090	.469	1.290
323 Urinary Stones Age > 70 And/Or C.C.	21.42	1.060	.283	1.140
324 Urinary Stones Age <70 W/O C.C.	34.74	1.060	.283	1.130
325 Kidney & Urinary Tract Signs & Symptoms	5.89	1.030	.173	1.060
326 Kidney & Urinary Tract Signs & Symptoms	2.12	1.010	.100	1.020
327 Kidney & Urinary Tract Signs & Symptoms	.97	1.120	.400	1.260
328 Urethral Stricture Age > 70 And/Or C.C.	.49	1.040	.200	1.090
329 Urethral Stricture Age 18-69 W/O C.C.	.24	1.000	.000	1.000
330 Urethral Stricture Age 0-17	.11	1.000	.000	1.000
331 Other Kidney & Urinary Tract Diagnoses A	13.17	1.040	.300	1.130
332 Other Kidney & Urinary Tract Diagnoses A	4.39	1.060	.316	1.150
333 Other Kidney & Urinary Tract Diagnoses A	2.38	1.060	.245	1.120
334 Major Male Pelvic Procedures With C.C.	9.88	1.000	.000	1.010
335 Major Male Pelvic Procedures W/O C.C.	8.01	1.000	.000	1.000
336 Transurethral Prostatectomy Age > 70 And	95.75	1.010	.100	1.010
337 Transurethral Prostatectomy Age <70 W/O	19.72	1.010	.100	1.010
338 Testes Procedures, For Malignancy	4.10	1.010	.100	1.010
339 Testes Procedures, Non-Malignant Age > 1	4.48	1.010	.100	1.020
340 Testes Procedures, Non-Malignant Age 0-1	3.37	1.000	.000	1.000
341 Penis Procedures	12.51	1.010	.100	1.030
342 Circumcision Age> 18	.09	1.000	.000	1.000
343 Circumcision Age 0-17	.26	1.000	.000	1.000
344 Other Male Reproductive System O.R. Proc	2.23	1.030	.173	1.060
345 Other Male Reproductive System O.R. Proc	1.21	1.020	.141	1.030
346 Malignancy, Male Reproductive System, Ag	4.35	1.070	.245	1.130
347 Malignancy, Male Reproductive System, Ag	.75	1.030	.173	1.060
348 Benign Prostatic Hypertrophy Age > 70 An	4.30	1.010	.100	1.010
349 Benign Prostatic Hypertrophy Age <70 W/O	.97	1.000	.000	1.000
350 Inflammation Of The Male Reproductive Sy	6.29	1.020	.200	1.070
351 Sterilization, Male	.04	1.000	.000	1.000
352 Other Male Reproductive System Diagnoses	2.10	1.010	.100	1.020
353 Pelvic Evisceration, Radical Hysterectom	2.18	1.000	.000	1.000
354 Non-Radical Hysterectomy Age > 70 And/Or	8.18	1.010	.100	1.020
355 Non-Radical Hysterectomy Age <70 W/O C.C	11.36	1.000	.000	1.000
356 Female Reproductive System Reconstructiv	41.89	1.010	.100	1.020
357 Uterus & Adenexa Procedures, For Maligna	6.33	1.020	.141	1.040
358 Uterus & Adenexa Proc For Non-Malignancy	56.84	1.000	.000	1.000
359 Tubal Interruption For Non-Malignancy	212.48	1.010	.100	1.020
360 Vagina, Cervix & Vulva Procedures	6.13	1.010	.100	1.020
361 Laparoscopy & Endoscopy (Female) Except	11.60	1.010	.100	1.010
362 Laparoscopic Tubal Interruption	.95	1.000	.000	1.000
363 D&C, Conization & Radio-Implant, For Mal	1.79	1.070	.265	1.130
364 D&C, Conization Except For Malignancy	5.01	1.000	.000	1.010
365 Other Female Reproductive System O.R. Pr	7.26	1.010	.100	1.020
366 Malignancy, Female Reproductive System A	3.40	1.100	.300	1.170
367 Malignancy, Female Reproductive System A	1.19	1.080	.265	1.140

APPENDIX 2 (continued)

368 Infections, Female Reproductive System	23.98	1.050	.224	1.100
369 Menstrual & Other Female Reproductive Sy	24.07	1.020	.141	1.030
370 Cesarean Section With C.C.	66.08	1.000	.000	1.000
371 Cesarean Section W/O C.C.	218.48	1.000	.000	1.000
372 Vaginal Delivery With Complicating Diagn	108.24	1.000	.000	1.000
373 Vaginal Delivery W/O Complicating Diagno	839.54	1.000	.000	1.000
374 Vaginal Delivery With Sterilization And/	53.40	1.000	.000	1.000
375 Vaginal Delivery With O.R. Proc Except S	.73	1.000	.000	1.000
376 Postpartum Diagnoses W/O O.R. Procedure	12.73	1.020	.100	1.030
377 Postpartum Diagnoses With O.R. Procedure	3.75	1.020	.141	1.040
378 Ectopic Pregnancy	28.87	1.020	.141	1.040
379 Threatened Abortion	48.11	1.230	.608	1.530
380 Abortion W/O D&C	8.38	1.000	.000	1.010
381 Abortion With D&C	21.20	1.010	.100	1.010
382 False Labor	27.22	1.090	.332	1.190
383 Other Antepartum Diagnoses With Medical	65.49	1.220	.686	1.610
384 Other Antepartum Diagnoses W/O Medical C	45.64	1.200	.721	1.640
385 Neonates, Died Or Transferred	30.26	1.070	.265	1.130
386 Extreme Immaturity, Neonate	16.12	1.020	.141	1.040
387 Prematurity With Major Problems	30.90	1.030	.200	1.070
388 Prematurity W/O Major Problems	27.73	1.020	.141	1.040
389 Full Term Neonate With Major Problems	132.43	1.020	.141	1.030
390 Neonates With Other Significant Problems	218.64	1.010	.100	1.010
391 Normal Newborns	906.35	1.030	.173	1.040
392 Splenectomy Age > 18	4.65	1.000	.000	1.000
393 Splenectomy Age 0-17	1.28	1.000	.000	1.000
394 Other O.R. Procedures Of The Blood & Blo	3.37	1.020	.141	1.040
395 Red Blood Cell Disorders Age > 18	29.71	1.230	1.010	2.060
396 Red Blood Cell Disorders Age 0-17	3.84	1.450*	.995	2.130
397 Coagulation Disorders	8.69	1.160	.906	1.870
398 Reticuloendothelial & Immunity Disorders	10.99	1.100	.332	1.200
399 Reticuloendothelial & Immunity Disorders	4.79	1.050	.224	1.100
400 Lymphoma Or Leukemia With Major O.R. Pro	7.96	1.020	.141	1.050
401 Lymphoma Or Leukemia With Minor O.R. Pro	2.71	1.010	.100	1.020
402 Lymphoma Or Leukemia With Minor O.R. Pro	2.82	1.000	.000	1.000
403 Lymphoma Or Leukemia Age > 70 And/Or C.C	12.29	1.170	.480	1.370
404 Lymphoma Or Leukemia Age 18-69 W/O C.C.	4.79	1.130	.387	1.260
405 Lymphoma Or Leukemia Age 0-17	1.54	1.210	.520	1.440
406 Myeloprolif Disord Or Poorly Diff Neopla	3.15	1.010	.100	1.030
407 Myeloprolif Disord Or Poorly Diff Neopl	1.68	1.010	.100	1.020
408 Myeloprolif Disord Or Poorly Diff Neopl	9.53	1.050	.224	1.090
409 Radiotherapy	6.82	1.180	.436	1.340
410 Chemotherapy	123.81	2.480**	1.954	4.020
411 History Of Malignancy W/O Endoscopy	.95	1.000	.000	1.000
412 History Of Malignancy With Endoscopy	.04	1.000	.000	1.000
413 Othr Myeloprolif Disord Or Poorly Diff N	6.07	1.080	.332	1.180
414 Othr Myeloprolif Disord Or Poorly Diff N	1.04	1.040	.200	1.080
415 O.R. Procedure For Infectious & Parasiti	17.80	1.040	.224	1.090
416 Septecemia Age > 18	30.84	1.040	.224	1.080
417 Septecemia Age 0-17	7.37	1.080	.346	1.190
418 Postoperative & Post-Traumatic Infection	15.48	1.020	.141	1.040
419 Fever Of Unknown Origin Age > 70 And/Or	13.10	1.050	.245	1.110
420 Fever Of Unknown Origin Age 18-69 W/O C.	2.47	1.030	.141	1.050
421 Viral Illness Age > 18	14.67	1.010	.100	1.020

APPENDIX 2 (continued)

422	Viral Illness & Fever Of Unknown Origin	22.34	1.040	.200	1.070
423	Other Infectious & Parasitic Diseases Di	5.07	1.060	.283	1.130
424	O.R. Procedures With Principal Diagnosis	2.87	1.000	.000	1.000
425	Acute Adjust React & Disturbances Of Psy	20.65	1.060	.300	1.140
426	Depressive Neuroses	48.17	1.060	.283	1.130
427	Neuroses Except Depressive	22.81	1.060	.265	1.130
428	Disorders Of Personality & Impulse Contr	11.32	1.210	.656	1.570
429	Organic Disturbances & Mental Retardatio	18.97	1.060	.265	1.120
430	Psychoses	250.15	1.310	.762	1.740
431	Childhood Mental Disorders	8.01	1.120	.469	1.310
432	Other Diagnoses Of Mental Disorders	4.59	1.060	.283	1.130
433	Substance Use & Subst Induced Organic Me	16.48	1.090	.346	1.200
434	Drug Dependence	13.74	1.040	.200	1.080
435	Drug Use Except Dependence	62.09	1.120	.436	1.290
436	Alcohol Dependence	44.76	1.020	.141	1.040
437	Alcohol Use Except Dependence	39.04	1.030	.173	1.060
438	Alcohol & Substance Induced Organic Ment				
439	Skin Grafts For Injuries	2.05	1.000	.000	1.000
440	Wound Debridements For Injuries	10.19	1.020	.141	1.040
441	Hand Procedures For Injuries	4.10	1.000	.000	1.000
442	Other O.R. Procedures For Injuries Age >	34.28	1.140	.520	1.380
443	Other O.R. Procedures For Injuries Age <	22.06	1.030	.224	1.080
444	Multiple Trauma Age > 70 And/Or C.C.	3.07	1.010	.100	1.010
445	Multiple Trauma Age 18-69 W/O C.C.	5.85	1.010	.141	1.030
446	Multiple Trauma Age 0-17	1.57	1.010	.100	1.030
447	Allergic Reactions Age > 18	2.87	1.010	.100	1.010
448	Allergic Reactions Age 0-17	.37	1.000	.000	1.000
449	Toxic Effects Of Drugs Age > 70 And/Or C	34.72	1.040	.245	1.100
450	Toxic Effects Of Drugs Age 18-69 W/O C.C	27.79	1.030	.200	1.060
451	Toxic Effects Of Drugs Age 0-17	13.76	1.020	.141	1.030
452	Complications Of Treatment Age > 70 And/	22.57	1.070	.300	1.160
453	Complications Of Treatment Age <70 W/O C	12.07	1.030	.200	1.070
454	Other Injuries, Poisonings & Toxic Eff D	3.20	1.010	.100	1.020
455	Other Injuries, Poisonings & Toxic Eff D	2.89	1.010	.100	1.030
456	Burns, Transferred To Another Acute Care	.55	1.040	.200	1.080
457	Extensive Burns	.29	1.000	.000	1.000
458	Non-Extensive Burns With Skin Grafts	5.43	1.010	.100	1.020
459	Non-Extensive Burns With Wound Debrideme	1.99	1.020	.141	1.040
460	Non-Extensive Burns W/O O.R. Procedure	9.75	1.020	.141	1.040
461	O.R. Proc With Diagnoses Of Other Contac	13.32	1.010	.100	1.030
462	Rehabilitation	70.50	1.070	.283	1.140
463	Signs & Symptoms With C.C.	6.60	1.030	.200	1.060
464	Signs & Symptoms W/O C.C.	3.79	1.010	.100	1.010
465	Aftercare With History Of Malignancy As	.26	1.080	.283	1.150
466	Aftercare W/O History Of Malignancy As S	6.31	1.020	.141	1.030
467	Other Factors Influencing Health Status	23.91	1.300	1.136	2.290
468	Principal Procedure Not Agree With Dx	85.01	1.020	.141	1.030
469	Invalid Principal Dx	.26	1.000	.000	1.000
470	Ungroupable	7.76	1.040	.200	1.080
471	Bilateral/ Mult. Joint Procedures lower	1.48	1.000	.000	1.000
472		.40	1.000	.000	1.000
473		6.13	1.440	.748	1.830
475		.02	1.000		9999.0
999	Drg Cannot Be Assigned				

APPENDIX 3. Estimates of MAF for Procedures (ICD9 codes).

m = admission rate per 100,000.
m' = mean number of admissions, among those with at least one admission.
s' = standard deviation of number of admissions, among those with at least one admission.
MAF = Multipe Admission Factor.

ICD9	PROCEDURE DESCRIPTION	m	m'	s'	MAF
0124	OTHER CRANIOTOMY	12.35	1.031	.212	1.070
0309	SPINAL CANAL EXPLOR NEC	47.51	1.014	.122	1.030
0331	SPINAL TAP	82.69	1.059	.267	1.140
3142	LARYGNOSCOPY/TRACHEOSCOP	12.64	1.061	.282	1.140
3322	FIBER-OPTIC BRONCHOSCOPY	23.54	1.042	.205	1.080
3323	OTHER BRONCHOSCOPY	13.17	1.040	.205	1.080
3324	ENDOSCOPIC BRONCHIAL BX	23.29	1.034	.198	1.070
3404	INSERT INTERCOSTAL CATH	29.32	1.067	.270	1.150
3491	THORACENTESIS	34.96	1.144	.431	1.310
3601	PTCA-NO THROMBOLYSIS	56.20	1.134	.368	1.250
3611	AORTOCOR BYPAS-1 COR ART	11.82	1.002	.043	1.000
3612	AORTOCOR BYPAS-2 COR ART	24.04	1.000	.000	1.000
3613	AORTOCOR BYPAS-3 COR ART	28.78	1.002	.039	1.000
3614	AORTCOR BYPAS-4+ COR ART	23.78	1.000	.000	1.000
3615	1 INT MAM-COR ART BYPASS	40.28	1.001	.033	1.000
3721	RT HEART CARDIAC CATH	15.00	1.085	.323	1.200
3722	LEFT HEART CARDIAC CATH	139.56	1.065	.279	1.140
3723	RT/LEFT HEART CARD CATH	73.83	1.029	.181	1.060
3772	INSERT TEMP PACEMAK NEC	11.29	1.012	.108	1.020
3774	INSER PERM PACEM VENT-TV	15.57	1.004	.065	1.010
3812	HEAD NECK ENDARTER NEC	34.59	1.084	.277	1.150
3844	ABD AORTA RESECT W REPL	13.79	1.002	.040	1.000
3891	ARTERIAL CATHETERIZATION	21.22	1.037	.229	1.090
3893	VENOUS CATHETER NEC	55.96	1.073	.302	1.160
3925	AORTA-ILIAC-FEMOR BYPASS	11.12	1.014	.118	1.030
3929	VASC SHUNT BYPASS NEC	27.55	1.069	.270	1.140
3949	VASC PROC REVISION NEC	13.87	1.217	.516	1.460
3961	EXTRACORPOREAL CIRCULAT	55.85	1.004	.069	1.010
3962	HYPOTHERMIA W OPEN HEART	12.93	1.003	.058	1.010
3964	INTRAOP CARDIAC PACEMAK	15.22	1.003	.054	1.010
3995	HEMODIALYSIS	41.78	1.830	.876	2.980
4011	LYMPHATIC STRUCT BIOPSY	17.27	1.018	.134	1.040
4029	SIMP EXC LYMPH STRUC NEC	12.20	1.007	.085	1.010
403	REGIONAL LYMPH NODE EXC	14.49	1.006	.078	1.010
4131	BONE MARROW BIOPSY	36.31	1.096	.344	1.230
431	TEMPORARYGASTROSTOMY	16.23	1.008	.091	1.020
4413	GASTROSCOPY NEC	21.53	1.049	.236	1.100
4414	BRUSH BIOPSY OF STOMACH	12.49	1.016	.140	1.040
4513	SM BOWEL ENDOSCOPY NEC	136.52	1.077	.309	1.170
4523	FLEX FIBEROPTIC COLONOSC	27.62	1.033	.183	1.070
4524	LG BOWEL ENDOSCOPY NEC	60.84	1.046	.216	1.100
4525	LARGE BOWEL BRUSH BIOPSY	11.21	1.012	.109	1.020
4562	PART SM BOWEL RESECT NEC	17.18	1.013	.113	1.030

APPENDIX 3 (continued)

4573	RIGHT HEMICOLECTOMY	19.63	1.006	.075	1.010
4576	SIGMOIDECTOMY	24.99	1.013	.111	1.020
470	APPENDECTOMY	96.33	1.000	.022	1.000
471	INCIDENTAL APPENDECTOMY	48.64	1.000	.022	1.000
4946	HEMORRHOIDECTOMY	11.80	1.008	.087	1.010
5011	PERCUTAN LIVER BIOPSY	12.00	1.024	.155	1.050
5012	LIVER BIOPSY NEC	11.21	1.002	.044	1.000
5122	TOTAL CHOLECYSTECTOMY	162.21	1.001	.023	1.000
5141	CDE FOR CALCULUS REMOV	11.98	1.004	.061	1.010
5197	ENDOSCOP OP BILIARY-ORAL	11.54	1.118	.377	1.240
5411	EXPLORATORY LAPAROTOMY	43.85	1.010	.100	1.020
5421	LAPAROSCOPY	37.68	1.014	.116	1.030
544	DESTRUCT PERITONEAL TISS	16.26	1.005	.074	1.010
545	PERITONEAL ADHESIOLYSIS	82.06	1.018	.133	1.040
5491	ABDOMINAL PARACENTESIS	13.68	1.163	.488	1.370
560	TU REMOV URETER OBSTRUCT	17.47	1.029	.167	1.060
5732	CYSTOSCOPY NEC	124.51	1.039	.215	1.080
5749	TU DESTRUC BLADD LES NEC	29.21	1.083	.314	1.190
5794	INSERT INDWELLING CATH	34.61	1.062	.242	1.210
595	RETROPUBIC URETH SUSPENS	28.92	1.002	.039	1.010
5979	URIN INCONTIN REPAIR NEC	11.40	1.000	.000	1.000
598	URETERAL CATHETERIZATION	25.67	1.063	.262	1.150
6011	PROSTATIC NEEDLE BIOPSY	11.71	1.002	.043	1.000
602	TRANSURETHRAL PROSTATECT	136.93	1.013	.115	1.030
605	RADICAL PROSTATECTOMY	12.07	1.000	.000	1.000
640	CIRCUMCISION	249.25	1.014	.117	1.030
6529	LOCAL DESTR OVA LES NEC	24.44	1.016	.124	1.030
654	UNILAT SALPINGO-OOPHOREC	39.44	1.005	.067	1.010
6561	REMOVE BOTH TUBES OVAR	108.26	1.001	.029	1.000
658	TUBO-OVARIAN ADHESIOLYS	18.73	1.007	.099	1.020
6632	BILAT TUBAL DIVISION NEC	62.05	1.000	.019	1.000
6639	BILAT TUBAL DESTRUCT NEC	33.13	1.000	.000	1.000
6662	REMOV TUBE ECTOP PREG	17.29	1.005	.071	1.010
684	TOTAL ABD HYSTERECTOMY	167.31	1.001	.035	1.000
685	VAGINAL HYSTERECTOMY	61.63	1.001	.033	1.000
6902	D C POST DELIVERY	23.34	1.013	.115	1.030
6909	D C NEC	24.35	1.004	.060	1.010
7050	CYSTOCEL/RECTOCEL REPAIR	24.75	1.001	.030	1.000
7051	CYSTOCELE REPAIR	15.20	1.003	.054	1.010
721	LOW FORCEPS W EPISIOTOMY	87.72	1.001	.023	1.000
7271	VACUUM EXT DEL W EPISIOT	45.86	1.000	.000	1.000
7279	VACUUM EXTRACT DEL NEC	12.40	1.000	.000	1.000
7301	INDUCT LABOR-RUPT MEMB	12.49	1.000	.000	1.000
7309	ARTIF RUPT MEMBRANES NEC	232.95	1.001	.034	1.000
734	MEDICAL INDUCTION LABOR	90.11	1.035	.201	1.090
7359	MANUAL ASSIST DELIV NEC	157.45	1.004	.060	1.010
736	EPISIOTOMY	334.41	1.001	.029	1.000
741	LOW CERVICAL C-SECTION	281.74	1.001	.036	1.000
751	DIAGNOSTIC AMNIOCENTESIS	11.12	1.057	.232	1.120
7532	FETAL EKG	58.72	1.002	.047	1.000
7534	FETAL MONITORING NOS	88.14	1.021	.167	1.060
754	MANUAL REMOVAL-PLACENTA	20.45	1.000	.000	1.000
7561	REPAIR OB LAC BLAD/URETH	13.65	1.000	.000	1.000
7562	REPAIR OB LAC RECT/ANUS	41.20	1.001	.023	1.000

APPENDIX 3 (continued)

7569	REPAIR OB LACERATION NEC	221.90	1.002	.041	1.000
7751	BUNIONECT/SFT/OSTEOTOMY	11.18	1.063	.243	1.120
7779	EXCISE BONE FOR GFT NEC	29.54	1.012	.109	1.020
7781	OTH CHEST CAGE OSTECTOMY	14.82	1.014	.116	1.030
7855	INTERNAL FIXATION-FEMUR	11.29	1.020	.140	1.040
7865	REMOVE INT FIX DEV-FEMUR	11.32	1.018	.133	1.040
7902	CL FX REDUC-RADIUS/ULNA	12.77	1.007	.083	1.010
7906	CL FX REDUC-TIBIA/FIBULA	12.66	1.023	.162	1.050
7932	OP RED-INT FIX RAD/ULNA	14.36	1.020	.141	1.040
7935	OPEN REDUC-INT FIX FEMUR	51.42	1.020	.145	1.040
7936	OP RED-INT FIX TIB/FIBUL	49.17	1.014	.122	1.030
7939	OPN FX RED W INT FIX NEC	12.44	1.020	.140	1.040
8026	KNEE ARTHROSCOPY	46.12	1.013	.112	1.020
8051	IV DISC EXCISION	95.66	1.026	.161	1.050
806	EXCIS KNEE SEMILUN CARTL	25.17	1.009	.094	1.020
8102	OTHER CERVICAL FUSION	16.94	1.008	.088	1.020
8107	LUMBOSACRAL FUSION	10.54	1.000	.000	1.000
8141	TOTAL KNEE REPLACEMENT	42.48	1.057	.232	1.110
8145	CRUCIATE LIG REPAIR NEC	30.62	1.002	.047	1.000
8147	OTHER REPAIR OF KNEE	14.03	1.011	.105	1.020
8151	TOT HIP REPLACE-METHACRY	27.31	1.025	.156	1.050
8159	OTHER TOTAL HIP REPLACE	31.94	1.033	.178	1.060
8161	REPLAC FEM HEAD-METHACRY	12.33	1.007	.085	1.010
8162	REPLACE FEMORAL HEAD NEC	14.56	1.009	.095	1.020
8182	REP RECUR SHLDER DISLOC	11.21	1.020	.140	1.040
8183	SHOULDER ARTHROPLAST NEC	30.04	1.012	.115	1.020
8191	ARTHROCENTESIS	12.00	1.079	.285	1.150
8363	ROTATOR CUFF REPAIR	23.69	1.024	.153	1.050
8512	BREAST BIOPSY NEC	14.36	1.008	.088	1.020
8532	BILAT REDUCT MAMMOPLASTY	12.88	1.000	.000	1.000
8543	UNILATERAL MASTECTOMY	39.42	1.010	.100	1.020
8604	OTHER SKIN SUBQ I D	26.23	1.044	.232	1.120
8622	WOUND DEBRIDEMENT	73.52	1.113	.374	1.240
863	OTHER LOCAL DESTRUC SKIN	27.62	1.022	.145	1.040
8659	SKIN SUTURE NEC	47.51	1.011	.108	1.020
8669	FREE SKIN GRAFT NEC	22.43	1.073	.308	1.160
8703	C.A.T. SCAN OF HEAD	240.08	1.076	.304	1.170
8721	CONTRAST MYELOGRAM	72.81	1.018	.138	1.040
8741	C.A.T. SCAN OF THORAX	21.29	1.040	.217	1.080
8744	ROUTINE CHEST X-RAY	44.25	1.172	.452	1.470
8753	INTRAOPER CHOLANGIOGRAM	108.28	1.001	.035	1.000
8762	UPPER GI SERIES	26.89	1.019	.137	1.040
8764	LOWER GI SERIES	14.05	1.014	.143	1.030
8773	INTRAVENOUS PYELOGRAM	54.15	1.029	.190	1.060
8774	RETROGRADE PYELOGRAM	16.92	1.031	.195	1.070
8801	C.A.T. SCAN OF ABDOMEN	68.05	1.051	.240	1.110
8838	OTHER C.A.T. SCAN	48.84	1.029	.183	1.060
8841	CONTR CEREBR ARTERIOGRAM	42.88	1.051	.233	1.110
8842	CONTRAST AORTOGRAM	26.20	1.015	.127	1.030
8848	CONTRAST ARTERIOGRAM-LEG	21.84	1.092	.314	1.180
8853	LT HEART ANGIOCARDIOGRAM	110.73	1.035	.195	1.070
8856	CORONAR ARTERIOGR-2 CATH	143.02	1.063	.272	1.130
8857	CORONARY ARTERIOGRAM NEC	33.86	1.019	.151	1.040
8866	CONTRAST PHLEBOGRAM-LEG	22.23	1.029	.173	1.060

APPENDIX 3 (continued)

8871	DX ULTRASOUND-HEAD/NECK	30.04	1.010	.098	1.020
8872	DX ULTRASOUND-HEART	78.66	1.031	.181	1.060
8874	DX ULTRASOUND-DIGESTIVE	16.04	1.006	.074	1.010
8875	DX ULTRASOUND-URINARY	21.62	1.039	.206	1.100
8876	DX ULTRASOUND-ABDOMEN	95.77	1.036	.193	1.070
8878	DX ULTRASOUND-GRAV UTER	30.20	1.069	.296	1.160
8879	DX ULTRASOUND NEC	16.94	1.051	.249	1.110
8914	ELECTROENCEPHALOGRAM	32.34	1.037	.206	1.080
8929	OTHER GU SYSTEM EXAMS	63.26	1.083	.300	1.240
8941	TREADMILL STRESS TEST	14.89	1.007	.086	1.010
8951	RHYTHM ELECTROCARDIOGRAM	27.00	1.131	.366	1.310
8952	ELECTROCARDIOGRAM	13.04	1.109	.387	1.240
8954	ELECTROCARDIOGRAPH MONIT	20.62	1.083	.337	1.190
8961	ARTERIAL PRESSURE MONIT	12.71	1.025	.156	1.050
8962	CVP MONITORING	20.47	1.029	.198	1.070
8964	PULMON ART WEDGE MONITOR	32.01	1.027	.166	1.050
8965	ARTERIAL BLD GAS MEASURE	38.03	1.137	.419	1.340
9205	C-VASC SCAN/ISOTOP FUNCT	21.64	1.028	.166	1.050
9214	BONE SCAN	35.62	1.021	.143	1.040
9215	PULMONARY SCAN	37.39	1.029	.180	1.060
9339	PHYSICAL THERAPY NEC	118.45	1.115	.382	1.250
9383	OCCUPATIONAL THERAPY	29.84	1.114	.371	1.240
9392	MECHAN RESP ASSIST NEC	37.15	1.028	.169	1.060
9394	NEBULIZER THERAPY	20.78	1.191	.450	1.540
9396	OXYGEN ENRICHMENT NEC	16.04	1.069	.283	1.170
9399	OTHER RESP PROCEDURES	14.40	1.058	.279	1.130
9412	ROUTINE PSYCHIAT VISIT	17.03	1.125	.416	1.330
9425	PSYCHIAT DRUG THERAP NEC	65.89	1.098	.346	1.230
9604	INSERT ENDOTRACHEAL TUBE	35.49	1.017	.134	1.030
9607	INSERTGASTRIC TUBE NEC	21.53	1.032	.203	1.070
9633	GASTRIC LAVAGE	14.65	1.033	.202	1.070
9904	PACKED CELL TRANSFUSION	58.06	1.115	.392	1.280
9915	PARENTERAL NUTRITION	10.61	1.137	.428	1.380
9925	INJECT CA CHEMOTHER NEC	109.93	2.091	.976	3.610
9929	INJECT/INFUSE NEC	13.19	1.055	.249	1.190
9962	HEART COUNTERSHOCK NEC	18.53	1.076	.280	1.290
9982	ULTRAVIOLET LIGHT THERAP	34.14	1.026	.171	1.050
A	HCFA PTCA	63.66	1.120	.345	1.240
B	HCFA CARDIAC CATH	226.27	1.071	.290	1.150
C	HCFA INGUINAL HERN REPAIR	35.67	1.000	.000	1.020
D	HCFA PROSTATECTOMY	155.20	1.017	.130	1.030
E	HCFA HYSTERECTOMY	230.28	1.001	.030	1.000
F	HCFA REDUCT FX OF FEMUR	63.50	1.019	.143	1.040
G	CAROTID ENDARTERECTOMY	34.48			1.150
H	PART EXCIS LARGE INTESTINE	65.36			1.030
I	CHOLECYSTECTOMY	162.50			1.000
J	TOTAL KNEE REPLACEMENT	41.69			1.070
K	TOTAL HIP REPLACEMENT	58.87			1.060
L	OTHER ARTHROPLASTY OF HIP	29.87			1.030
M	SINUS PROCEDURES	15.88			1.040
N	TONSILLECTOMY	12.53			1.000
O	HEMORRHOIDECTOMY	12.88			1.010
P	APPENDECTOMY	96.30			1.000
Q	GASTRECTOMY	10.79			1.000

APPENDIX 3 (continued)

R	AMPUTATION OF LIMB	29.73	1.230
S	MASTECTOMY	45.24	1.030
T	THYROIDECTOMY	16.35	1.030